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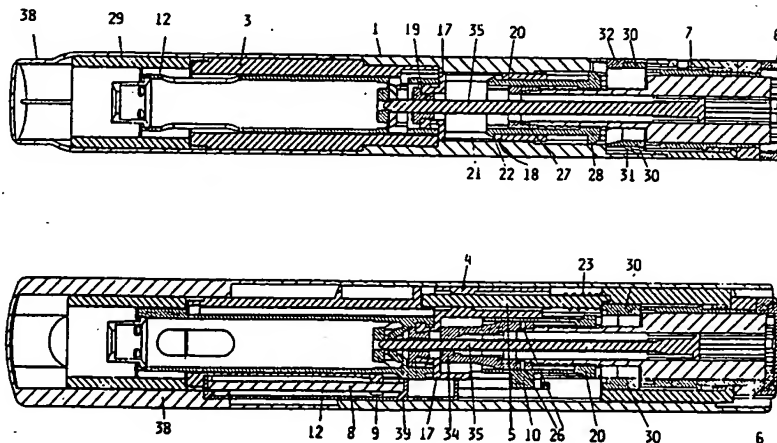
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(54) Title: AN AUTOMATIC PEN-SHAPED SYRINGE



(57) Abstract

A pen-shaped syringe with automatic needle insertion has an injection system integrally displaceable in a housing (1) and comprising a basic part (17) carrying a medicine reservoir with a hypodermic needle at its distal end, and a dosing mechanism with a carrier (34) engaging a cogged piston rod (35), the carrier being coupled to a dose spindle (25) in a rotatable but not displaceable way. The dose spindle (25) is provided with a thread engaging a thread in a sequence part (20) having protrusions (22) engaging slots (21) in the basic part (17) to allow a limited axial movement of the parts (20, 17) in relation to each other, the extent of the movement being defined by the rotational position of the dose spindle (25). A spring (23) is compressed between the basic part (17) and the housing (1) when the basic part is moved in the proximal direction by exerting a cocking force on the sequence part (20), which part after having performed the set limited axial movement in relation to the basic part (17) carries this basic part against the force of the spring (23).

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An automatic pen-shaped syringe.

The invention relates to pen-shaped syringes with automatic needle insertion, which syringes have an injecting system comprising a basic part carrying a medicine reservoir being at its distal end provided with a hypodermic needle and
5 being at its proximal end closed by a piston, a dosing mechanism having a carrier engaging a cogging on a piston rod to advance this rod in the distal direction to press the piston into the reservoir a distance corresponding to a set dose when an injection button is pressed, the injection system being integrally displaceable in a housing by a spring which may be compressed and released to displace the
10 injection system in the distal direction in the housing to insert the needle into the skin of a patient.

Such pen shaped syringes are used by patients who treat themselves by frequently injecting a medicine dose which may be set individually immediately before each injection, and the setting is deleted when the injection is performed.
15 Often the same dose is used by a number of injections, and consequently some patients might wish for a syringe by which the dose does not have to be set before each injection. Especially patients to whom a reduced tactile motor function makes it difficult to perform the setting would appreciate a syringe by which a setting is not deleted by the injection, but is remembered until it is altered voluntarily.

20 It is the object of the invention to provide a syringe with automatic needle insertion, which syringe stores a setting of the dose and automatically sets that dose when the automatic needle insertion mechanism of the syringe is cocked.

This is obtained by a pen shaped syringe as described above, which syringe according to the invention is characterized in, that the carrier is coupled to
25 a dose spindle in a rotatable but not displaceable way, the dose spindle being provided with a thread engaging a thread in a sequence part, the sequence part and the basic part of the injection system being provided with mutually engaging protrusions and slots allowing a set limited axial movement of these parts in relation to each other, the basic part being affected by a spring mounted to be compressed
30 when the basic part is moved in the proximal direction in the housing by cocking forces exerted on the sequence part.

According to the invention, a ramrod may be mounted displaceably axially in the housing with an outer end accessible for operating the ramrod, and an inner end abutting a protrusion on the sequence part. Thereby it is ensured that the cocking force is exerted on the sequence part.

5 When the injection button has a diameter at least corresponding to the minor diameter of the housing and is secured to the dose tube at the proximal end of the syringe, this button may be gripped easily, even by patients with reduced tactile motor function, and by drawing the button in the proximal direction the force exerted on the button may via the dose spindle and the thread engaging the thread
10 of the sequence part be transmitted to this part as a cocking force.

In the following the invention is described in further details with reference to the drawing, wherein

- Figure 1 shows a sectional view along the axis of a pen-shaped syringe according to the invention,
- 15 Figure 2 shows a sectional view along the axis of the syringe in Figure 1 perpendicular to the view in that Figure,
- Figure 3 shows a protective cap seen from its proximal end.

The pen shaped syringe with an automatic insertion of a needle shown in Figures 1 and 2 in its uncocked position comprises a housing 1 having an oval
20 cross section and with a bore accommodating the mechanism for automatic needle insertion, dose setting, and injection. Partly inserted into the distal end of the housing 1 an intermediate tube 3 extends from this housing. At the outer end of the intermediate tube 3 a spacing tube 29 is mounted, which spacing tube 29 determines the depth of the needle insertion. An injecting system comprising a basic
25 part 17 and a tubular reservoir holding member 12 is accommodated axially displaceably in the housing 1 and the intermediate tube 3. The tubular reservoir holding member 12 is releasably secured to the basic part 17 by a bayonet coupling.

The reservoir holding member 12 accommodates a reservoir for the
30 medicine to be injected and carries at its distal end a hub with a hypodermic needle.

The basic part is made unrotatable in the housing by having a side projection 4 with a bore by which it is guided along a guiding bar 5 in the housing. The guiding bar 5 is further surrounded by a helical spring 23 compressed between the housing and the side projection 4 to urge this projection, and consequently the basic part 17 and the member 12 in a distal direction in the housing.

A mainly tubular sequence part 20 is displaceable in the basic part 17 within limits set by hooks 22 extending into slots 21 in the sides of the basic part 17. At its proximal end, the sequence part 20 is provided with an internal thread engaged by an external thread 24 on a dose setting spindle 25. At its proximal end, the dose setting spindle is provided with a button 6 which may be rotated to set a dose before the needle insertion mechanism is cocked, and be pressed to inject the set dose when the needle has been inserted into the skin of the patient. This button has a diameter corresponding to the minor diameter of the housing and is along its outer cylindric surface provided with grooves to provide for a good grip for the fingers when the button shall be rotated.

A piston rod 35 having a mainly square cross section and being cogged along two opposite sides and smooth along the other two sides is during its normal use maintained unrotatable in the housing by being guided through a piston rod guide 19. The cogging is engaged by a carrier 34 which is mounted to the distal end of the dose setting spindle 25 by a hair pin shaped locking pin engaging slots 26 in the carrier 34 and an annular recess 27 at the end of the spindle 25. By this arrangement, the spindle 25 may be rotated in relation to the carrier 34, but the carrier will follow axial movements of the spindle. Further, the carrier 34 is guided in the sequence part 20 to be unrotatable in relation to this part and consequently in relation to the housing.

When the syringe is in its neutral uncocked position, as shown in Figures 1 and 2, the set dose is determined by the distance of the hooks 22 of the sequence part 20 from the proximal terminal surfaces 18 of the slots 21 in the basic part 17. This distance may be adjusted by rotating the button 6 to rotate the spindle 25. Due to its engagement with the thread of this spindle and its unrotatable guidance in the basic part 17 the sequence part 20 will travel along the spindle altering its position in the basic part. The set dose may be read from not shown

digits along the outer surface of a drum 7 coupled to the button 6 to follow the rotational position of this button, but without being axially displaced in the housing. The rotational position of the drum 7 is indicated by a digit appearing in a window in the wall of the housing.

5 The syringe is cocked by actuating the sequence part in the proximal direction. By this actuating the button is lifted from the end of the housing due to the thread connection between the sequence part 20 and the spindle 25, and the spindle 25 will draw the carrier in the proximal direction making its teeth ride over the teeth of the cogging of the piston rod 35. When the hooks 22 reach the terminal
10 surfaces 18 of the slots 21, the basic part 17 will follow the sequence part 20 in its further displacement in the proximal direction, and the helical spring 23 will be compressed. As now the whole injection system is displaced, no further relative movement of the carrier and the piston rod is performed, and this relative movement has consequently been restricted to the movement defined by the original distance
15 established between the hooks 22 and the surfaces 18 by setting the dose.

When the sequence part 20 is passed in the proximal direction, a flange 28 provided at its proximal end will pass through a trigger ring 30 which is pushed to an eccentric position by a leaf spring 31. When passing the trigger ring
20 30 the flange 28 will incidentally against the force of the leaf spring 31 push the trigger ring into a position coaxial with the housing, and when the flange has passed the spring 31 will again push the trigger ring 30 to its eccentric position, and movement of the sequence part in the distal direction will be locked by the flange abutting the proximal side of the trigger ring 30.

Now the distal end of the spacing tube 29 is pressed against the skin
25 where an injection shall be given. A trigger button 32 is pressed, and the trigger ring 30 is thereby pushed out of its eccentric position into a position coaxial with the housing. Thereby the locking engagement between trigger ring 30 and the flange 28 of the sequence part is released, and the spring 23 can push the basic part 17 in the distal direction. Thereby the needle mounted at the distal end of the member
30 12 is pressed through the skin of the patient and is ready for injection. During its movement in the distal direction the basic part 17 draws the sequence part with it due to the hooks 22 engaging the surface 18. The movement of the basic part is

stopped by abutting the end of the intermediate tube 3. The position of the sequence part 20 is now as at the beginning of the loading when the compression of the spring 23 has not yet begun, i.e. the button is lifted over the end of the syringe a distance corresponding to the set dose. This dose may now be injected
5 by pressing the button until it abuts the end of the syringe. By this pressing the carrier 34 will carry the piston rod 35 in the distal direction, and the piston rod will press the piston further into the ampoule and press out some of the content of this ampoule through the needle.

The cocking actuation of the sequence part in the proximal direction
10 may be obtained by pulling the button 6 and the spindle 25, which due to its thread engagement with the sequence part 20 will draw this part with it. Alternatively, the cocking may be performed by operating a ramrod 39 adjacent to the outer wall of the intermediary tube 3 and displaceably in the axial direction thereof in a bore in the housing. To cock the needle insertion mechanism the ramrod 39 is pressed into the
15 bore 2 in the housing 1 against the force of a retraction spring 12 surrounding a guiding bar 8 in the ramrod 39 and being compressed between an end of the ramrod and a ramrod guide 9 on the intermediary tube 3. When pressed into the housing 1 the ramrod 39 will engage a protrusion 10 on the sequence part, and further pressing of the ramrod will cause the actuation of the sequence part in the
20 proximal direction.

A protective cap 38 having the same cross section as the housing 1 has a bore 43 fitting over the protruding end of the intermediary tube 3. The inner wall of the cap further has a longitudinal recess 42 accommodating the ramrod 39. Figure 3 shows the cap seen from its open end. If the cap 38 is pulled off so far that
25 the ramrod 39 is free it may be rotated about the intermediate tube 3 and the spacing tube 29. Thereby the cap may be used for operating the ramrod which now abuts the proximal edge of the cap 38, which cap guided on the intermediate tube provides a handle by which the ramrod may be pressed into the housing 1.

CLAIMS

1. A pen-shaped syringe with automatic needle insertion, which syringe has an injecting system comprising a basic part (17) carrying a medicine reservoir being at its distal end provided with a hypodermic needle, and being at its proximal
5 end closed by a piston, a dosing mechanism having a carrier (34) engaging a cogging on a piston rod (35) to advance this rod in the distal direction to press the piston of the reservoir a distance corresponding to a set dose when an injection
button (6) is pressed, the injection system being integrally displaceable in a housing
(1) by a spring (23) which may be compressed and released to displace the
10 injection system in the distal direction in the housing to insert the needle into the skin of a patient, characterized in, that the carrier (34) is coupled to a dose spindle (25) in a rotatable but not displaceable way, the dose spindle (25) being provided with a thread engaging a thread in a sequence part (20), the sequence part (20) and the
basic part (17) of the injection system being provided with mutually engaging
15 protrusions (22) and slots (21) allowing a set limited axial movement of these part (20,17) in relation to each other, the basic part (17) being affected by a spring (23) mounted to be compressed when the basic part (17) is moved in the proximal direction in the housing (1) by cocking forces exerted on the sequence part (20).

2. A pen-shaped syringe according to claim 1, characterized in, that a
20 ramrod (39) is mounted axially displaceably in the housing (1) with an outer end accessible for operating the ramrod (39) and an inner end abutting a protrusion on the sequence part (20).

3. A pen-shaped syringe according to claim 1 or 2, characterized in,
that the injection button (6) has a diameter at least corresponding to the minor
25 diameter of the housing (1) and is secured to the dose spindle (25) at the proximal end of the syringe.

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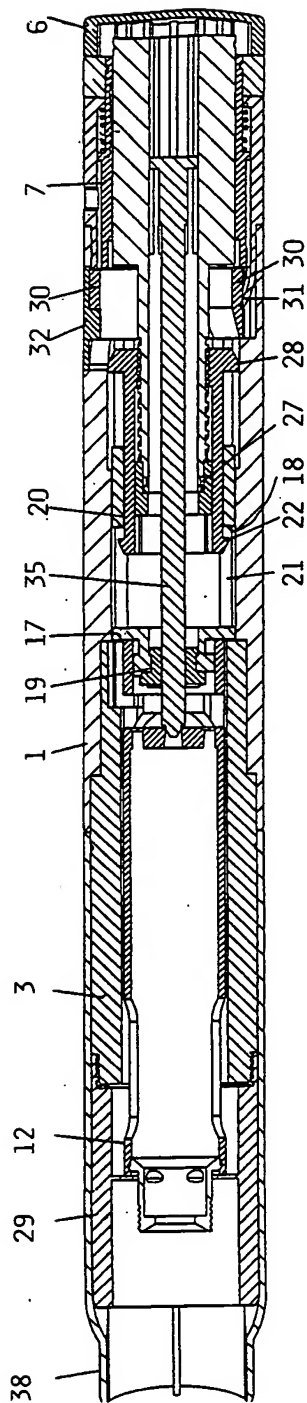


Fig. 1

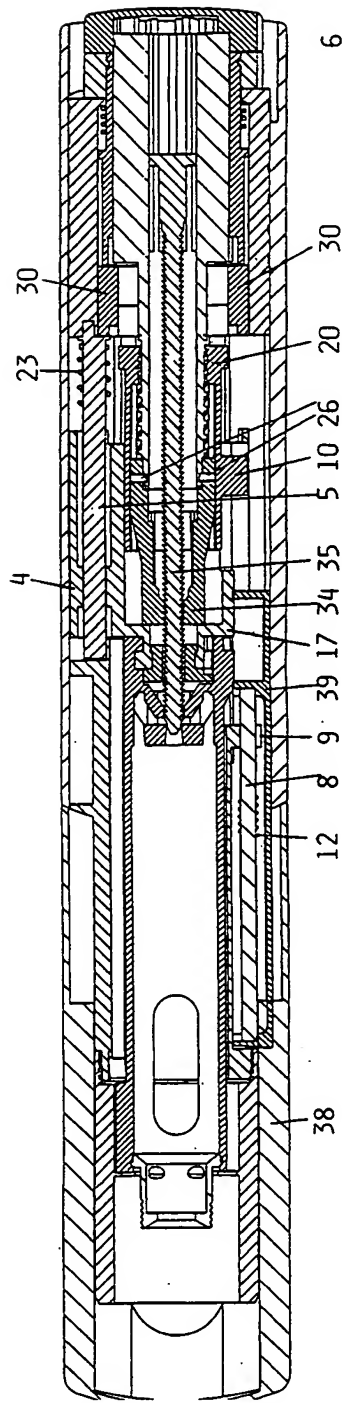


Fig. 2

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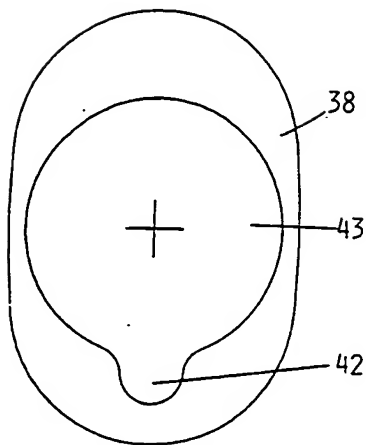


Fig. 3

INTERNATIONAL SEARCH REPORT

International Application No. PCT/DK 92/00358

I. CLASSIFICATION OF SUBJECT MATTER (If several classification symbols apply, indicate all) ⁶ According to International Patent Classification (IPC) or to both National Classification and IPC IPC5: A 61 M 5/20								
II. FIELDS SEARCHED <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Minimum Documentation Searched⁷</div> <table style="width: 100%; border-collapse: collapse;"> <tr> <th style="width: 25%; border-bottom: 1px solid black;">Classification System</th> <th style="width: 75%; border-bottom: 1px solid black;">Classification Symbols</th> </tr> <tr> <td style="height: 40px; vertical-align: top; border: 1px solid black;">IPC5</td> <td style="height: 40px; vertical-align: top; border: 1px solid black;">A 61 M</td> </tr> </table> <div style="text-align: center; border-top: 1px solid black; border-bottom: 1px solid black;">Documentation Searched other than Minimum Documentation to the extent that such Documents are included in Fields Searched⁸</div>			Classification System	Classification Symbols	IPC5	A 61 M		
Classification System	Classification Symbols							
IPC5	A 61 M							
SE,DK,FI,NO classes as above								
III. DOCUMENTS CONSIDERED TO BE RELEVANT⁹ <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="width: 10%; padding: 5px;">Category[*]</th> <th style="width: 60%; padding: 5px;">Citation of Document,¹¹ with indication, where appropriate, of the relevant passages¹²</th> <th style="width: 30%; padding: 5px;">Relevant to Claim No.¹³</th> </tr> </thead> <tbody> <tr> <td style="height: 300px; vertical-align: top; border: 1px solid black;">A</td> <td style="height: 300px; vertical-align: top; border: 1px solid black;"> DE, A, 2040076 (N.V. PHILIPS'GLOEILAMPENFABRIEKEN) 4 March 1971, see the whole document <div style="text-align: center; margin-top: 100px;">-----</div> </td> <td style="height: 300px; vertical-align: top; border: 1px solid black;">1-3</td> </tr> </tbody> </table>			Category [*]	Citation of Document, ¹¹ with indication, where appropriate, of the relevant passages ¹²	Relevant to Claim No. ¹³	A	DE, A, 2040076 (N.V. PHILIPS'GLOEILAMPENFABRIEKEN) 4 March 1971, see the whole document <div style="text-align: center; margin-top: 100px;">-----</div>	1-3
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<div style="display: flex; justify-content: space-between;"> <div style="width: 45%;"> <p>[*] Special categories of cited documents:¹⁰</p> <p>^{"A"} document defining the general state of the art which is not considered to be of particular relevance</p> <p>^{"E"} earlier document but published on or after the international filing date</p> <p>^{"L"} document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)</p> <p>^{"O"} document referring to an oral disclosure, use, exhibition or other means</p> <p>^{"P"} document published prior to the international filing date but later than the priority date claimed</p> </div> <div style="width: 45%;"> <p>^{"T"} later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention</p> <p>^{"X"} document of particular relevance, the claimed invention cannot be considered novel or cannot be considered to involve an inventive step</p> <p>^{"Y"} document of particular relevance, the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art</p> <p>^{"&"} document member of the same patent family</p> </div> </div>								
IV. CERTIFICATION <table style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of the Actual Completion of the International Search 22nd February 1993 </td> <td style="width: 50%; border-bottom: 1px solid black; padding: 5px;"> Date of Mailing of this International Search Report 04 -02- 1993 </td> </tr> <tr> <td style="border-bottom: 1px solid black; padding: 5px;"> International Searching Authority <div style="text-align: center; margin-top: 10px;">SWEDISH PATENT OFFICE</div> </td> <td style="border-bottom: 1px solid black; padding: 5px;"> Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;">May Hallne</div> </td> </tr> </table>			Date of the Actual Completion of the International Search 22nd February 1993	Date of Mailing of this International Search Report 04 -02- 1993	International Searching Authority <div style="text-align: center; margin-top: 10px;">SWEDISH PATENT OFFICE</div>	Signature of Authorized Officer <div style="text-align: center; margin-top: 10px;">May Hallne</div>		
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ANNEX TO THE INTERNATIONAL SEARCH REPORT ON INTERNATIONAL PATENT APPLICATION NO. PCT/DK 92/00358

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Patent document cited in search report	Publication date	Patent family member(s)	Publication date
DE-A- 2040076	71-03-04	AT-A-B- 312792	73-12-15
		BE-A- 755224	71-02-24
		CA-A- 956195	74-10-15
		CH-A- 512250	71-09-15
		FR-A- 2059187	71-05-28
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		NL-A- 6912969	71-03-01
		SE-B-C- 374659	75-03-17
		US-A- 3742948	73-07-03